AF
ZJW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Eschbach	)	Examiner:	Thompson, James A
Serial No.: 09/737,512	)	Art Unit:	2624
Filed: 12/15/2000	)	Conf. No.:	9563
For: FAST IMPLEMENTATION OF HOMOMORPHIC FILTERS FOR IMAGE ENHANCEMENT	)		
Attorney Docket No.: A0114-US-NP / XERZ 2 0319	)	Cleveland, Ohio	September 7, 2005

TRANSMITTAL OF APPELLANT'S BRIEF (37 C.F.R. § 41.37)

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Fee for Appellant's Brief (37 C.F.R. § 41.20)

An Appellant's Brief in compliance with 37 C.F.R. § 41.37 is transmitted herewith. The fee required by §41.20(b)(2) of **$500** (and any other fee now due) should be charged to **Deposit Account 24-0037 (Xerox Corporation).**

Time Extension

If any extension of time is required, please consider this a petition for same and charge the fees to **Deposit Account 24-0037 (Xerox Corporation)**.

Respectfully submitted,

Steven M. Haas (Reg. No. 37,841)
Fay, Sharpe, Fagan, Minnich & McKee, LLP
1100 Superior Avenue - Seventh Floor
Cleveland, Ohio 44114
(216)861-5582

Certificate of Mailing - 37 C.F.R. § 1.8

I hereby certify that this correspondence is being transmitted by first class U.S. Mail with sufficient postage addressed to: **Mail Stop Appeal Brief – Patents**, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on:

September 7, 2005
Date

Steven M. Haas

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Eschbach	)	Examiner: Thompson, James A
Serial No.: 09/737,512	)	Art Unit: 2624
Filed: 12/15/2000	)	Conf. No.: 9563
For: FAST IMPLEMENTATION OF HOMOMORPHIC FILTERS FOR IMAGE ENHANCEMENT	)	
Attorney Docket No.: A0114-US-NP XERZ 2 0319	)	Cleveland, Ohio September 7, 2005

37 C.F.R. § 41.37 – APPELLANT'S BRIEF

MAIL STOP APPEAL BRIEF - PATENTS
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

This appeal brief stems from the Notice of Appeal filed July 7, 2005.

The § 41.20 fees and any time extension have been addressed in the accompanying Transmittal for Appeal Brief.

Certificate of Mailing - 37 C.F.R. § 1.8
I hereby certify that this correspondence is being transmitted by first class U.S. Mail with sufficient postage addressed to: **Mail Stop Appeal Brief – Patents**, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on:

September 7, 2005 Steven M. Haas

Date Steven M. Haas

Real Party in Interest - 37 C.F.R. § 41.37(c)(1)(i)

The real party in interest is the assignee, XEROX CORPORATION.

Related Appeals and Interferences - 37 C.F.R. § 41.37(c)(1)(ii)

None.

Status of Claims - 37 C.F.R. § 41.37(c)(1)(iii)

Status of claims:

- allowed claims: **none**
- rejected claims: **7 and 10-12**
- canceled claims: **1-6, 8, 9 and 13-15**
- claims being appealed: **7 and 10-12**

Status of Amendments - 37 C.F.R. § 41.37(c)(1)(iv)

There are no amendments that were filed after final rejection.

Summary of the Claimed Subject Matter - 37 C.F.R. § 41.37(c)(1)(v)

Independent Claim 7

Claim 7 is directed to a method for enhancing a digital image exhibiting uneven exposure in a xerographic or other non-impact printing/copying environment (12,14,16).

The method includes receiving input data that define an input image that exhibits uneven exposure (S1). The input data are processed to derive lightsource data that represent an image of a lightsource in said input image (S2,S3). The step of deriving the lightsource data includes:

(i) subsampling the input data to obtain subsampled data defining a subsampled image (S2);

(ii) low-pass filtering the subsampled data by: (ii)(a) performing a Fourier transform operation on the subsampled data to define the subsampled data in the frequency domain (S3a); (ii)(b) low-pass filtering the subsampled data in the frequency domain (S3b); and, (ii)(c) performing an inverse of the Fourier transform operation on the low-pass filtered subsampled data to define the low-pass subsampled data in the spatial domain (S3c);

(iii) upsampling the low-pass filtered data to derive the lightsource data that define a full-scale image of the lightsource (S4a).

The overall method further includes deriving enhanced data that represent an enhanced version of said input image, said enhanced data obtained by removing the effect of said lightsource data from the input data (S5).

Grounds of Rejection to be Reviewed on Appeal - 37 C.F.R. § 41.37(c)(1)(vi)

Whether claims 7 and 10-12 are unpatentable according to 35 U.S.C. § 103(a) based upon U.S. Patent No. 5,185,671 to Lieberman et al. (Lieberman) in view of U.S. Patent No. 5,708,693 to Aach et al. (Aach).

Argument - 37 C.F.R. § 41.37(c)(1)(vii)

Whether claims 7 and 10-12 are unpatentable according to 35 U.S.C. § 103(a) based upon U.S. Patent No. 5,185,671 to Lieberman et al. (Lieberman) in view of U.S. Patent No. 5,708,693 to Aach et al. (Aach).

Independent Claim 7 and Dependent Claim 12

As is described in the background section of the present application, e.g., at page 4, lines 1-10, homomorphic filters have traditionally been implemented using high-pass filters on the image data, in order to filter the low-frequency "lightsource" data from the image. The data are transformed into the frequency domain, high-pass filtered, and then inversely transformed back to the spatial domain. As is also described, this conventional high-pass homomorphic filtering cannot be performed on sub-sampled or down-sampled image data to decrease processing time because the sub-sampled and high-pass filtered data must then be up-sampled to return the image to its original size. Unfortunately, it has been found that up-sampling of *high-pass filtered data* is very unreliable and sensitive to image noise. As a consequence, conventional high-pass homomorphic filtering is performed on the full-size (not sub-sampled) image data which is very slow and unsuitable for modern image reproduction (printing/copying) applications where throughput must be maximized.

Lieberman is directed to exactly such a conventional high-pass homomorphic filtering system as described at col. 4, line 36 – col. 5, line 15 thereof. Lieberman does not disclose or suggest that sub-sampled data can be used in the homomorphic filtering operation. This is acknowledged by the Examiner in the April 7, 2005 final Office Action at page 5, line 25 – page 6, line 7.

With conventional high-pass homomorphic filtering such as disclosed in Lieberman, the high-pass filtering, itself, directly removes the effects of the lightsource from the image

data, there is no need to perform a subsequent subtraction or division or other "removal" operation on the original input data, i.e., the high-pass filter removes the effects of the lightsource directly. *This is in contrast to the method defined in claim 7, which can be used in real-world applications where speed is required, wherein the lightsource data must first be derived and then removed from the original data in a secondary operation.*

Aach relates to an image processing method for reducing noise in an image. Aach does not relate to homomorphic filtering. Aach does not mention or even suggest deriving lightsource data from input image data and, therefore, does not disclose any removal operation for removing the effects of the lightsource data from the original input data (such as by subtraction specified in dependent claim 10 or division as specified in dependent claim 11). Instead, the image processing of Aach is concerned with removing noise artifacts from image data, without removing important information as is critical in connection with medical diagnostic images. In an effort to identify noise, the image is separated into multiple resolution levels and a comparison is made between image features of the various resolution levels in order to identify noise artifacts to be filtered from each image level. An output image is then constructed by combining the filtered images. As part of this process, Aach disclose the general use of low-pass filtering in combination with sub-sampling, but nothing in the Aach et al. document discloses or fairly suggests a low-pass alternative to conventional high-pass homomorphic filtering as defined in amended claim 7.

Based upon these distinctions, independent claim 7 is respectfully submitted to define patentably over Lieberman in view of Aach. Dependent claims 10-12 are submitted to be allowable with claim 7.

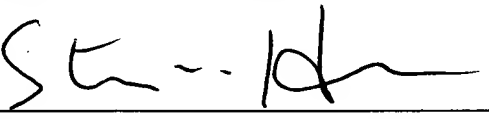
Dependent Claims 10 and 11

In addition to being allowed with independent claim 7, claims 10 and 11 should be deemed to define allowable subject matter based upon the additional limitations specified respectively therein, over and above the limitations of claim 7. Dependent claims 10 and 11 are also submitted to define allowable subject matter, because these claims define the method further as including a subtraction operation (claim 10) or a division operation (claim 11) in order to remove the effect of the previously-derived lightsource data from the input data to derive the enhanced data. Such steps are not disclosed or suggested by any document of record. The Lieberman et al. method uses the conventional high-pass filter which directly removes the low-pass lightsource data from the full-scale (not sub-sampled data) without requiring any subsequent subtraction/division step, while the Aach et al. document is unconcerned with deriving or removing the lightsource data. As such, claims 10 and 11 are respectfully submitted to define patentably over Lieberman in view of Aach.

Conclusion

It is respectfully submitted that claims 7 and 10-12 are in condition for allowance. A Notice of Allowance is respectfully requested.

Respectfully submitted,



Steven M. Haas (Reg. No. 37,841)
Fay, Sharpe, Fagan, Minnich & McKee, LLP
1100 Superior Avenue - Seventh Floor
Cleveland, Ohio 44114
(216)861-5582

Attachments: Claims Appendix / Evidence Appendix / Related Proceedings Appendix

Claims Appendix - 37 C.F.R. § 41.37(c)(1)(viii)

1. (canceled)
2. (canceled)
3. (canceled)
4. (canceled)
5. (canceled)
6. (canceled)

7. (previously presented) In a xerographic or other non-impact printing/copying environment, a method for enhancing a digital image exhibiting uneven exposure, said method comprising:

receiving input data that define an input image that exhibits uneven exposure;

deriving from said input data lightsource data that represent an image of a lightsource in said input image, said step of deriving lightsource data comprising:

(i) subsampling said input data to obtain subsampled data defining a subsampled image;

(ii) low-pass filtering said subsampled data, wherein said step of low-pass filtering comprises: (ii)(a) performing a Fourier transform operation on said subsampled data to define said subsampled data in a frequency domain; (ii)(b) low-pass filtering said subsampled data in the frequency domain; and, (ii)(c) performing an inverse of said Fourier transform operation on said low-pass filtered subsampled data to define said low-pass subsampled data in a spatial domain;

(iii) upsampling said low-pass filtered data to derive said lightsource data that define a full-scale image of said lightsource;

deriving enhanced data that represent an enhanced version of said input image, said enhanced data obtained by removing the effect of said lightsource data from the input data.

8. (canceled)
9. (canceled)

10. (original) The method as set forth in claim 7, wherein said step of deriving enhanced data comprises subtracting said lightsource data from said input data.

11. (original) The method as set forth in claim 7, wherein said step of deriving enhanced data comprises dividing said input data by said lightsource data.

12. (previously presented) The method as set forth in claim 7, wherein said step of upsampling said low-pass filtered data to derive said lightsource data that define a full-scale image of said lightsource comprises interpolating said low-pass filtered data using a linear interpolating method.

13. (canceled)
14. (canceled)
15. (canceled)

Evidence Appendix - 37 C.F.R. § 41.37(c)(1)(ix)

None.

Related Proceedings Appendix - 37 C.F.R. § 41.37(c)(1)(x)

None.